

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date  
22 January 2004 (22.01.2004)

PCT

(10) International Publication Number  
WO 2004/008657 A1

(51) International Patent Classification<sup>7</sup>: H04B 7/10,  
H01Q 21/00

S. [GB/GB]; c/o Philips Intellectual Property & Standards, Cross Oak Lane, Redhill, Surrey RH1 5HA (GB).  
BOYLE, Kevin, R. [GB/GB]; c/o Philips Intellectual Property & Standards, Cross Oak Lane, Redhill, Surrey RH1 5HA (GB).

(21) International Application Number:  
PCT/IB2003/003010

(74) Agent: WHITE, Andrew, G.; Philips Intellectual Property & Standards, Cross Oak Lane, Redhill, Surrey RH1 5HA (GB).

(22) International Filing Date: 8 July 2003 (08.07.2003)

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(25) Filing Language: English

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

(26) Publication Language: English

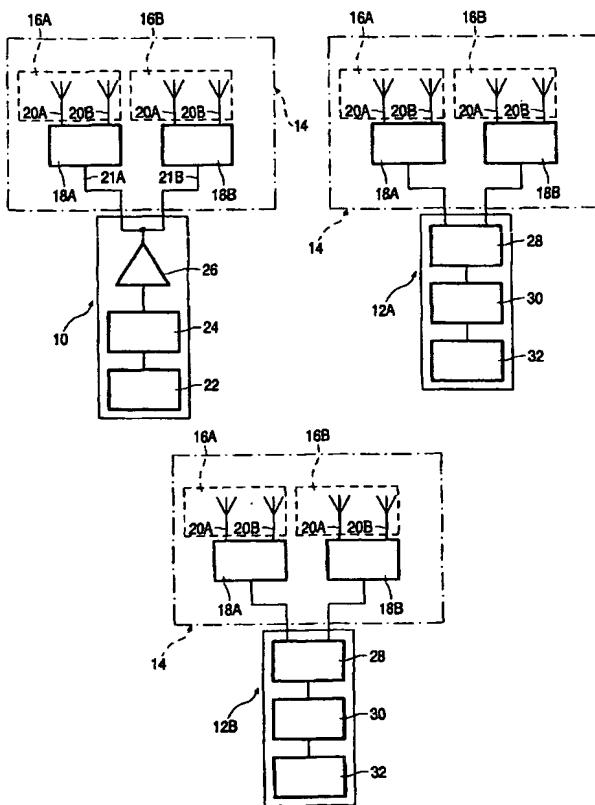
[Continued on next page]

(30) Priority Data:  
0216060.4 11 July 2002 (11.07.2002) GB

(71) Applicant (for all designated States except US): KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL];  
Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and  
(75) Inventors/Applicants (for US only): KHATRI, Bhavin,

(54) Title: IMPROVEMENTS IN OR RELATING TO MULTIPLE TRANSMISSION CHANNEL WIRELESS COMMUNICATION SYSTEMS



(57) Abstract: A multiple transmission channel wireless communication system such as MIMO system, comprises a transmitting station and at least one receiving station, at least one of said stations having an antenna system comprising a plurality of spaced apart antenna elements (16A, 16B), each antenna element comprising a sub-array of at least 2 antennas (20A, 20B) separated by less than half the wavelength of the frequency of interest. The antennas of each of the antenna elements may be controllable to give directional propagation or reception.



Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

— *with international search report*

## INTERNATIONAL SEARCH REPORT

National Application No  
PCT/EP 03/03010

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04B7/10 H01Q21/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B H01Q H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 050 923 A (LUCENT TECHNOLOGIES INC) 8 November 2000 (2000-11-08) column 2, line 36 – line 41 column 3, line 12 – line 15 column 4, line 36 – line 58 -----	1-14
Y	EP 0 108 816 A (INT STANDARD ELECTRIC CORP) 23 May 1984 (1984-05-23) page 5, line 5 – line 14 claims 1,2,6,7 -----	1-14

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

## \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

2 October 2003

Date of mailing of the international search report

17/10/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL – 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Mier, A

## INTERNATIONAL SEARCH REPORT

National Application No  
PCT/EP 03/03010

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP 1050923	A 08-11-2000	US 6304214 B1		16-10-2001
		AU 3024900 A		09-11-2000
		BR 0009616 A		23-04-2002
		CA 2307712 A1		07-11-2000
		CN 1273463 A		15-11-2000
		EP 1050923 A2		08-11-2000
		JP 2000349530 A		15-12-2000
EP 0108816	A 23-05-1984	EP 0108816 A1		23-05-1984